RX-DIB: Dual Informational Binding Framework

Consolidated Research Document & Experimental Roadmap v2.0

Original codename: Teoría del Todo Dual | **Author:** R. Navarro | **Reference:** RX-C → RX-IR → RXVM

Scientific status. RX-DIB is presented as an operational framework and falsifiable software benchmark, not as a demonstrated theory of fundamental physics. Its scientific value depends on measurement, preregistration, statistical analysis and independent replication.

1. Executive Summary

RX-DIB emerged from an earlier attempt to formulate a dual relationship between physical support and information. The framework was deliberately narrowed: cosmological and non-falsifiable claims were removed; the Reader/Action/Generation structure was formalized; and the incomputable Kolmogorov term K(I|R) was replaced by operational metrics that can actually be measured in software.

The immediate research question is: **does measurable representational distance predict coupling latency when semantic output is held constant?** The benchmark uses RX-C, RX-IR and RXVM so the same semantic mutation can be executed through native instructions, bytecode, source-level parsing and additional translation layers.

2. Consolidated Mathematical Model

Global state: $S_t = (M_t, I_t) \in M \times I$

Environment: $E_t \in E$

Coupling: $\chi_R(M_t, I_t, E_t) \in \{0,1\}$

Reader: $R : M \times I \times E \to A$

Action: $A_t = a_{null}$ if $\chi_R=0$; otherwise $A_t=R(M_t,I_t,E_t)$

Generative transition: $G : M \times I \times E \times A \to M \times I$

State update: $S_{t+1} = G(M_t, I_t, E_t, A_t)$

Generativity is defined operationally as a measurable state transition attributable to interpretation of I_t. This avoids treating information itself as an unexplained physical force.

3. Representational Distance and Coupling Latency

$D(I,R) = w■D_{encoding} + w■D_{syntax} + w■D_{dispatch}$

Component	Operational measurement	Main confound
Dencoding	Decoding, alignment and representation conversion work	Runtime/compiler implementation
Dsyntax	Parsing, AST construction and normalization	Parser design/optimization
Ddispatch	Indirect calls, dispatch tables and control-flow layers	Branch prediction/cache effects

Coupling latency is measured as $\tau_C = t■ - t■$, with explicit timestamps for detection, interpretation/dispatch and the chosen observable transition. Timestamp definitions must be frozen before the final benchmark.

4. RX-DIB Experimental Design

Semantic invariance: every representation must produce the same externally verified target mutation. A first target can be $x \leftarrow x + 1$, but the protocol must prevent dead-code elimination and verify the final state.

Condition	Representation	Purpose
C1	Native instruction	Hardware baseline
C2	RX-IR bytecode	VM decoding/dispatch

Condition	Representation	Purpose
C3	RX-C source	Lexical + syntactic processing
C4	Translated path	Additional indirection
C5	Full binding	Combined controlled overhead

Important correction: H■ should not simply say that all effects are zero. A stronger null is that any observed $D \rightarrow \tau_C$ relationship is explained by measured implementation and platform covariates. H■ should specify a reproducible residual relationship after those controls.

5. Statistical Plan: From Demo to Evidence

• **Pre-register:** hardware, compiler flags, optimization, CPU affinity, warm-up, input sizes, timestamp method and exclusion criteria.

• **Use distributions:** median, IQR, tail quantiles and confidence intervals for τC, not only means.

• **Control confounders:** frequency scaling, cache state, branch prediction, JIT warm-up, memory locality and OS interrupts.

• **Separate fitting from confirmation:** avoid choosing D weights or functional forms after seeing the final results.

• **Report effect size:** statistical significance alone does not establish a meaningful invariant.

• **Replicate:** begin with x86_64, then ARM64 and RISC-V where feasible.

6. New Research Fronts

A. Causal ablation of the Reader

Disable decoding, parsing, dispatch, caching or other stages individually and measure the resulting change.

B. Information-preserving transformations

Compare semantically equivalent representations with different syntax/encoding while holding computational output constant.

C. Hardware-counter validation

Add instructions-retired, cache-miss, branch-miss and cycle counters where available to separate D from ordinary microarchitectural overhead.

D. Energy coupling

Where reliable telemetry exists, measure energy/package power and test whether representational adaptation predicts energy after controlling for runtime. Landauer should only be invoked for logically irreversible erasure.

E. Runtime invariance

Repeat in C99 RXVM, Rust and a JIT/managed runtime to identify effects that survive implementation changes.

F. Neuromorphic extension

Later define an event/spike analogue as a new benchmark domain; do not assume software results transfer automatically to biology.

G. Biological modeling

Only after software evidence is established, compare the Reader→Action→Transition abstraction with molecular recognition and signaling models.

H. Formal methods

Specify RX-DIB operational semantics and prove semantic equivalence, determinism and telemetry non-interference properties.

7. Failure Modes and Controls

Risk	Mitigation
Dead-code elimination	Verify final state; prevent unjustified compiler removal.
CPU frequency scaling	Record/control frequency; use repeated cycle measurements.
Cache/branch contamination	Warm-up, randomized order and controlled conditions.
OS interrupts	CPU affinity, quiet system and robust statistics.
Instrumentation overhead	Benchmark telemetry overhead separately.
Overfitting D weights	Freeze weights or estimate them only on a training subset.
Semantic mismatch	Automated equivalence checks for the target mutation.

8. Concrete Next Steps

1. Freeze RX-DIB v2 definitions of t■, t■ and t■.

2. Implement an RX-DIB runner in RXVM with JSON/CSV telemetry.

3. Create four semantically equivalent implementations of one micro-operation.

4. Automate verification of identical target state.

5. Measure instrumentation overhead independently.

6. Run a 10,000–100,000 repetition pilot to characterize variance.

7. Pre-register the final experiment and analysis plan.

8. Run the factorial benchmark on at least two architectures.

9. Publish telemetry, scripts, environment manifests and analysis notebooks.

10. Invite independent replication before biological/physical extensions.

9. Scientific Positioning

RX-DIB should currently be described as a **research framework for experimentally studying information-to-execution coupling in computational systems**. It should not be presented as a confirmed replacement for computer architecture, information theory, thermodynamics or physics. Its strongest possible result would be a reproducible empirical regularity that survives implementation changes and predicts measurements beyond conventional performance models. If no invariant exists, the benchmark still has engineering value.

The earlier “Dual Theory of Everything” is best retained as the historical origin; RX-DIB is the narrower scientific research program.

10. Relation to PRISMA

PRISMA 3 provides a separate example of the project's methodological philosophy: subject variability is modelled rather than automatically discarded. Its supplied technical whitepaper reports real EEG evaluation on OpenNeuro DS007358 using 28 subjects and 3,304 windows with LOSO evaluation; subject-normalized accuracy is reported as 84.2% versus 71.5% for the stated raw-feature baseline. These results concern a defined eyes-closed/eyes-open research task and do not establish clinical performance. ■filecite■turn36file1■L451-L472■

11. Final Roadmap

Stage	Objective	Exit criterion
RX-DIB v2	Specification + runner	Reproducible local benchmark
Pilot	Variance/instrumentation study	Stable protocol
Factorial	Test D components	Pre-registered result
Cross-platform	x86_64 / ARM64 / RISC-V	Replication or bounded failure
Independent replication	External reproduction	Independent confirmation
Extensions	Energy / neuromorphic / formal methods	Validated new benchmarks
Biological modeling	Compare abstraction with existing models	Explicit model comparison

Source basis: supplied RX-DIB draft and Rogex PRISMA 3 Technical Whitepaper v1.2. The document distinguishes established engineering facts, supplied empirical results and hypotheses requiring new evidence.